IMPROVED FORMING PROCESS FOR STAMPED WORKPIECES

FIELD OF THE INVENTION

[00001] This invention relates to a stamped workpiece forming process, and more particularly to a stamped workpiece forming process for forming crease lines adjacent to protrusions. One application of this process is in the formation of an improved tab opener for cans. The tab opener has a predefined crease line adjacent to a protrusion in order to allow the user to easily lift the tab opener.

BACKGROUND OF THE INVENTION

[00002] Hundreds of millions of food and beverage can containers are manufactured and sold every year around the world. They are generally made of aluminum, but they may also be made of metals or plastics. Beverage can containers are generally opened with an integrated pull-tab which is riveted to the top of the can. The pull-tab is lifted at one end and pushes against a frangible push-in closure at the top of the can.

[00003] U.S. Patent Application **10/330,476** by the present inventors describes a number of embodiments of a new articulated tab opener for a food and beverage container. The tab includes at least one protrusion extending upwardly from the main webbing of the tab adjacent to a crease line. To open the can, the tab is first pulled upwardly with relative ease until the protrusion abuts either the webbing or an opposing protrusion. Then, the handle acts as a lever, with the rivet as the pivot point, allowing the can to be easily opened with minimal effort.

[00004] The improved tab opener has many advantages over previous tab openers. The ease of lifting the end of the tab opener helps to prevent fingernail damage. The ease of lifting is also useful for children and the elderly who may have difficulty lifting the tabs. In addition, can manufacturers have been reducing the size of the can top relative to the overall can diameter thus reducing the clearance between the edge of the tab opener and the periphery of the can top. The reduced clearance makes it more difficult for any user to put their fingernail or fingertip

underneath the tab opener to apply leverage. As a result, an easy lift tab opener becomes an even more desirable feature for consumers.

[00005] The many advantages of the new tab will not be realized, however, unless a method of forming the tab is devised. The individual features of the tab can be formed by using conventional progressive die techniques. Generally speaking, tabs openers are formed by feeding strips of aluminum wide enough to accommodate three tabs in parallel through a series of stamping or cutting operations until the tab is ready to be riveted onto aluminum can tops. While the improved tab design can be manufactured using a known process, it is difficult to form the crease line between the protrusions. Because the protrusions are positioned quite close to one another and extend significantly above the tab opener's upper surface, a very fine stamping element would be required to form the crease line between the protrusions. A very slight misalignment may result in damage to the protrusion, which may adversely impact the usefulness of the design. In addition, the creasing element may not have sufficient endurance to withstand the hundreds of thousands of stamping operations required by standard tab-forming processes.

[00006] The difficulty in using very fine or small tool elements to form cuts and creases between protrusions is not limited to aluminum tabs for cans. A wide variety of other stamped workpieces (e.g. various automobile parts) may need to use a fine tool element to form a crease line adjacent to or between protrusions.

[00007] Therefore there is a need for an improved process for performing creasing operations on stamped workpieces, and especially in tabs for metal cans.

SUMMARY OF THE INVENTION

[00008] Disclosed herein is a method of making a stamped workpiece from a base material sheet. The base material sheet has a thickness and defines a first plane. The stamped workpiece, upon completion of the process, has a protrusion and a crease line substantially adjacent thereto. The crease line divides the stamped workpiece into a first section and a second section. The method comprises a number of steps. One step in this method is the provision of at least one

protrusion in the base material sheet. A workpiece periphery is defined in the base material sheet, the periphery bounding an area of the base material sheet. The area has a first section and a second section. The workpiece periphery adjacent to the first section is substantially separated from the remainder of the base material sheet. The first section is bent away from the first plane along a crease line. The thickness of the base material sheet along the crease line is then substantially reduced. The workpiece is detached from the base material sheet along the workpiece periphery.

[00009] In another aspect of the present invention, the at least one protrusion comprises a first protrusion and a second protrusion. In a further aspect. the first protrusion is opposed to the second protrusion. Optionally, the first protrusion is positioned within the first section and the second protrusion is positioned within the second section.

[00010] In a variation of the present invention, the first protrusion and the second protrusion are each provided with an abutment face. In addition, the first and second protrusions are positioned such that the abutment faces are opposed one to the other.

[00011] In yet another aspect of the present invention, the method also includes the additional step of bending the first section back towards the first plane, such that the first section lies substantially coplanar with the second section.

[00012] In another embodiment of the present invention, there is further described herein a method for forming pull tabs for containers from a base material sheet. The base material sheet has a thickness and defines a first plane. The pull tab has a protrusion and a crease line substantially adjacent thereto. The crease line divides the stamped pull tab into a first section and a second section. The method comprises a number of steps. One step in this method is the provision of at least one protrusion in the base material sheet. A tab periphery is defined in the base material sheet, the tab periphery bounding an area of the base material sheet. The area has a first section and a second section. The tab periphery adjacent to the first section is substantially separated from the remainder of the base material sheet. The first section is bent away from the first plane along a crease line. The thickness of the base material sheet along the crease line is

then substantially reduced. Optionally, the workpiece is detached from the base material sheet along the workpiece periphery.

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[00014] In a variation of the present invention, the first protrusion and the second protrusion are each provided with an abutment face. In addition, the first and second protrusions are positioned such that the abutment faces are opposed one to the other.

[00015] In yet another aspect of the present invention, the method also includes the additional step of bending the first section back towards the first plane, such that the first section lies substantially coplanar with the second section.

[00016] In a yet further aspect, the first section is bent downwardly sufficiently to cause material deformation along the crease line. Optionally, the base material sheet is an elongated strip.

[00017] In addition, the steps of the method may be performed concurrently in a progressive die for sequential pull-tabs.

[00018] The strip may have a width sufficient to accommodate the formation of at least two pull tabs positioned parallel to one another. In such a variation, each of the steps may be performed concurrently for each of the at least two pull tabs positioned parallel to one another.

[00019] The method may further comprise the step of detaching the pull tab from the base material sheet along the tab periphery.

BRIEF DESCRIPTION OF THE DRAWINGS

[00020] The novel features which are believed to be characteristic of the present invention, as to its structure, organization, use and method of operation, together with further objectives and advantages thereof, will be better understood from the following drawings in which a presently preferred embodiment of the invention will now be illustrated by way of example. It is expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of the invention. Embodiments of this invention will now be described by way of example in association with the accompanying drawings in which:

Fig. 1 is a perspective view of a pull-tab to which this invention relates;

Fig. 2 is a perspective view of a strip showing the progressive cutting and stamping steps in sequential positions related to forming the pull-tab of **Figure 1** in accordance with the present invention;

Fig. 3 is an enlarged top view of the first three positions of the metal strip of **Figure 2**;

Fig. 4 is an enlarged top view of the fourth to sixth positions of the metal strip of **Figure 2**;

Fig. 5 is an enlarged top view of the seventh to ninth positions of the metal strip of **Figure 2**;

Fig. 6 is an enlarged top view of the tenth to twelfth positions of the metal strip of **Figure 2**;

Fig. 7 is a side view of the tenth to twelfth positions of the metal strip of **Figure 2**; and

Fig. 8 is a schematic side view showing the actions of the progressive die during the tenth to twelfth positions.

DETAILED DESCRIPTION

[00021] The novel features which are believed to be characteristic of the present invention, as to its structure, organization, use and method of operation, together with further objectives and advantages thereof, will be better understood from the following discussion.

[00022] **Figure 1** shows a tab opener **10** for a can having features which enable easy opening of the can. Tab opener **10** has a top webbing or surface **18**, a front nose portion **20** and a rear tail portion **22**. A rivet aperture **24** is made in a depressed portion or rivet island **26** located near nose portion **20**. Rivet hole **24** is adapted to receive a rivet for attachment to a top of a can. Rivet island **26** is defined by a curvilinear aperture **28** along its rear portion and a gently sloping rivet island wall **30** along its front portion. Rivet island wall **30** leads up to the webbing near the front tip of nose portion **20**.

[00023] The tail portion **20** is articulable. It comprises a front lever portion **40** and a rear lever portion **42**. Front lever portion **40** lies in the same plane, and is an extension of, nose portion **20** of tab opener **10**.

[00024] The tail portion comprises a base portion **44** and at least one pair of protrusions **46** which are upstanding therefrom. Typically there are four protrusions **46** arranged in pairs on either side of a crease line **48**, as shown in **Figure 1**. However, other arrangements of protrusions are possible as is shown in U.S. Patent Application No. **10/330,476**.

[00025] Each of protrusions **46** has an abutment or front face **50** which is subtended by and extends upwardly from crease line **48**. In the arrangement shown in **Figure 1**, the front faces **50** of opposed pairs of protrusions **46** are opposed to one another in close proximity. Typically, the angle which is formed between opposed front faces **50** is in the range of **10°** and **50°**.

[00026] Front lever portion **40** and nose portion **20** comprise a first section of tab opener **10**, while rear lever portion **42** comprise a second section, where the first and second sections are divided by crease line **48**.

[00027] A semi-circular finger hole **52** is located centrally in rear lever portion **42**, rearwardly of protrusions **46**.

[00028] Tab opener **10** will now be described in more detail by describing the process for forming tab opener **10**. **Figure 2** shows a strip **90** of aluminum (although metals, plastics or other materials could also be used) with thirteen positions (labelled **101 – 112**) used in the tab forming process. Each position represents one or more stamping or cutting operations required to form tab opener **10**. The twelve positions and operations described below are a simplification of the actual process required to form tab opener **10**, as is well known to those skilled in the art. For example the, formation of protrusions **46** may actually be a multi-step process which begins with forming relatively small dimples in strip **90** which are gradually increased in size.

[00029] Preferably, the tab openers are formed using a high-speed progressive die process, in which a single press is configured to perform many of the consecutive forming operations on successive tabs with a single downward motion. Optionally, some operations may be performed by rams or cams which move upwardly from below the strip. The strip is fed through the die and stopped at each of the positions **101 – 112** in order to perform the stepwise pressing and forming operations.

[00030] At position **101**, (as shown in **Figure 3**) a single press is used to cut rivet hole **24**. At position **102**, a press is used to form protrusions **46**. The press will typically form the protrusions by stopping strip **90** over a male protrusion stamp mould (not shown). A corresponding female press section will press downwardly on strip **90** until the male protrusion mould pushes upwardly into strip **90**, thus forming protrusions **46**. It will be obvious to those skilled in the art that a wide variety of mechanisms could also be used to achieve the same effect. At position **103**, (as shown in **Figure 3**), strip **90** is cut along lines **120** along a portion of the periphery proximate to protrusions **46**. The portion of the tab opener adjacent to lines **120** will be subsequently curled downwards, inwards and then upwards, as is known in the art. Each of lines **120** is divided into a front cut line and a rear cut line about joint **124**. Joint **124** serves to maintain continuity in the webbing between the tab opener and the surrounding strip.

[00031] At position **104** (as shown in **Figure 4**), rivet island **26** surrounding rivet aperture **24** is formed by pressing the webbing surrounding rivet island **26** downwardly using corresponding male and female press sections. In addition, curvilinear aperture **28** is also cut

around the rear portion of rivet island **26**. At position **105**, rivet island **26** is pressed even further downwardly resulting in the delineation of sloping walls **30**. At position **106**, finger hole **52** is cut in rear lever portion **42** rearwardly of protrusions **46**.

[00032] At position **107**, (as shown in **Figure 5**), the periphery of finger hole **52** is pressed downward, resulting in a downwardly slope edge in the finger hole. At position **108**, second peripheral cuts are made along lines **122**. These cuts extend rearwardly of the rear cut line made along lines **120** and define the sides of rear lever portion. At position **109**, additional peripheral cuts are made along lines **126** which extend forwardly of lines **120** to meet at a joint **128** at the front tip of nose portion **20**.

[00033] At position **110** (as shown in **Figure 6**), the final peripheral cuts are made along lines **130** between the rearmost ends of lines **122**. Joints **132** remain between lines **122** and lines **130**. At this stage, tab opener **10** is connected to strip **90** only along joints **124** and **132**. Lines **120**, **122**, **126**, and **130** thus define a tab periphery. In addition, at position **110**, as shown in Figures **6**, **7** and **8**, nose portion **20** is pushed downwardly by a press member **134**, causing joint **128** to break. (Optionally, joint **128** may be cut beforehand by a separate operation.) Joints **124** and **132** maintain rear lever portion **42** in the same plane as strip **90**. The downward motion of nose portion **20** may be enough to cause metal deformation of the webbing along crease line **48**. At position **111** as shown in Figures **7** and **8**, a creasing element or cutting or stamping implement **136** is pressed into crease line **48** to substantially reduce the thickness of the aluminum webbing along that line. As a result, crease line **48** can act as a hinge connecting front lever portion **40** and rear lever portion **42**. The reduction in thickness will allow users to more easily lift rear lever portion **42** from the top of a can.

[00034] After the cutting operation in position **111**, as shown in Figures **7** and **8**, nose portion **20** is pushed upwardly, back to its previous position in substantially the same plane as strip **90**. Preferable, an upwardly sloping surface **138** is positioned below the bent portion of tab opener **10**. As the strip is moved through the progressive die in the direction of arrow **A**, nose portion **20** abuts surface **138**, it will be raised to lie in the same plane as strip **90** at position **112**

(Optionally, the bent portion of tab opener **10** is pushed back to its previous position with a cam or spring activated mechanism located below the strip).

[00035] After passing through the above-described steps, tab opener **10** may have additional steps performed or may be completely severed from strip **90**, and is ready to be riveted to a can top.

[00036] Strip **90**, as shown, only accommodates a single row of tab openers. However, multiple rows may be used, either in parallel or in a staggered formation.

[00037] The astute observer will note that crease line **48** first appears in position **103** in **Figure 3**. As previously discussed, the formation of protrusions **48** may occur over a number of pressing operations. In the initial pressing operations for the formation of protrusions **48**, a first creasing element may be employed to make an initial crease along crease line **48**. This creasing element may be relatively blunt as compared to creasing element **136**. The initial, and shallower, formation of crease line **148** is possible given that protrusions **146** do not extend high enough in the initial stages to block formation of the crease line. In addition, the first crease line also assists in the bending of tab opener **10** at position **110**.

[00038] It will be obvious to those skilled in the art that the order of the actions performed on the tab may be rearranged to suit the needs of the manufacturer. For example, while lines **122** and **130** are cut prior to bending the nose section downwards, the cuts may be made after the bending operation.

[00039] It will also be clear to those skilled in the art that a number of possible and/or desirable edge curling operations are not described in detail. Aluminum edges can be very sharp and may cut a user's finger. As a result, many of the exposed edges may be subjected to curling operations to curl the edges underneath the tap opener.

[00040] It will be obvious to those skilled in the art that the techniques and processes described herein could be applied to other workpieces of a variety of sizes. Essentially, any workpiece having a crease line that separates a first section from a second section, where the crease line is less accessible for normal cutting or stamping operation because the crease line lies adjacent to a protrusion, can be formed using the bending technique described above.

[00041] Other modifications and alterations may be used in the design and manufacture of the apparatus and process of the present invention without departing from the spirit and scope of the accompanying claims.

[00042] Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise" and variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not to the exclusion of any other integer or step or group of integers or steps.